RTCA Special Committee 209

ATCRBS / Mode S Transponder

Meeting #3

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Identification of RTCA-DO-181C Test Procedures that are Candidates for Increasing the Number of Test Points

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SUMMARY

At SC209 Meeting #2, while discussing changes to test procedures in Working Paper WP02-05R1, a suggestion was made to increase the number of test points for applicable test procedures. The purpose of this Working Paper is to identify those test procedures that are candidates for discussion on this matter.

At SC209 Meeting #2, while discussing changes to test procedures in Working Paper WP02-05R1, a suggestion was made to increase the number of test points for applicable test procedures. Currently, most test procedures that vary a parameter, such as input power, often do so in 5 dB steps (for example). It is the perception that when the test procedures were originally written, the tests would be conducted via a manual procedure. Since developers may now have automated means of running tests, it is suggested that test procedures be expanded to include more measured points for a more thorough verification.

Since it is not desirable to increase test complexity when there is no technical reason to do so, each test procedure should be evaluated on a case-by-case basis. The purpose of this Working Paper is to identify test procedures that are candidates for discussion on this matter.

Environmental Tests

2.3.2.1 Receiver Characteristics (Paragraph 2.2.2)

Step 3 ATCRBS and ATCRBS/Mode S All-Call Dynamic Range
Currently approximately 5 dB steps.

Step 6 Mode S Dynamic Range (Paragraph 2.2.2.4 c.)
Tested at 3 power levels.

2.3.2.3.1 ATCRBS Reply Pulse Characteristics (Subparagraph 2.2.4.1)

Step 2 Reply Delay and Jitter (Subparagraph 2.2.4.1.6 a and b)
Tested at 3 power levels.

2.3.2.3.2 Mode S Replies (Subparagraph 2.2.4.2)

Step 1 Mode S Reply Delay and Jitter (Subparagraph 2.2.4.2.5 a)
Tested at 3 power levels.

Step 2 ATCRBS/Mode S All-Call Reply Delay and Jitter (Subparagraph 2.2.4.2.5 b)
Tested at 3 power levels.

2.3.2.4 Side Lobe Suppression (Subparagraph 2.2.5)

Step 2 SLS Dynamic Range [Subparagraph 2.2.5.1 a (2) and 2.2.5.1 c]
Tested at 4 power levels.

Step 3 SLS Pulse Ratio (Subparagraph 2.2.5.1 b)
Tested at 3 power levels.

2.3.2.5 Pulse Decoder Characteristics (Paragraph 2.2.6)

Step 5 Short Pulse Rejection, ATCRBS-Type Interrogations (Subparagraph 2.2.6.3 c)
Tested at 3 power levels.

2.3.2.6 Transponder Recovery and Desensitization (Paragraph 2.2.7)

Step 1 ATCRBS Single Pulse Desensitization and Recovery (Subparagraphs 2.2.7.1.1 and 2.2.7.2)

This test verifies desensitization by setting signal spacing to a specific value and then test recovery at another specific spacing. This test could be expanded to vary the spacing in 1-microsecond increments to acquire a more detailed measurement of desensitization and recovery characteristics.

2.3.2.7 Standard Interference Pulse (Subparagraph 2.2.8.2) and Mode S SLS

Several test steps performed at 2 or 3 power levels.

2.3.2.10 Diversity Operation (Paragraph 2.2.12)

Step 1 Single Channel Test (Subparagraphs 2.2.12.3 and 2.2.12.4)
Currently this test runs at 3 power levels. A more complete test would step the power levels in 1 dB steps.

Step 2 Selection Test (Subparagraph 2.2.12.1. b)
Currently the test uses one relative power level between the two channels. If the relative power level was varied in 1-dB steps, a more exact channel selection based on signal level would be determined.

Step 3 Delay-Selection Test (Subparagraph 2.2.12.2)
Currently the test uses one delay position. If the test was expanded to vary the range in 25 nanosecond steps, there would be more of an exact measure of the Delay Selection Tolerance.

Detailed Test Procedures

2.4.2.1 Receiver Characteristics (Paragraph 2.2.2)

Step 3 ATCRBS and ATCRBS/Mode S All-Call Dynamic Range (Subparagraph 2.2.2.4 f)
Currently uses 5 dB Steps.

Step 7 Mode S Dynamic Range (Subparagraph 2.2.2.4 c)
Currently uses 5 dB Steps.

2.4.2.3.2 ATCRBS Reply Delay and Jitter (Subparagraph 2.2.4.1.6)

Multiple Test Steps with 5 dB steps.

2.4.2.3.3 Mode S Replies (Subparagraph 2.2.4.2)

Step 7 Mode S Reply Delay and Jitter (Subparagraph 2.2.4.2.5 a)
Calls for varying the reply power over a range but does not specify the power increment to use.

Step 8 ATCRBS/Mode S All-Call Reply Delay and Jitter (Subparagraph 2.2.4.2.5 b)
Calls for varying the reply power over a range but does not specify the power increment to use.

2.4.2.4 Side Lobe Suppression (Paragraph 2.2.5 and Subparagraph 2.2.8.5)

Step 2 SLS Dynamic Range [Subparagraphs 2.2.5.l a (2) and 2.2.5.l c]

Step 3 SLS Pulse Ratio (Subparagraph 2.2.5.1 b)

Step 4 SLS Pulse Ratio (Subparagraph 2.2.5.1 a and b)

Each test step is run at 4 or so levels. A test sequence using 1 dB power increments would provide a more comprehensive measurement of SLS characteristics.

2.4.2.5 Pulse Decoder Characteristics (Paragraph 2.2.6) Equipment Required

Step 1 Pulse Level Tolerances, ATCRBS/Mode S All-Call (Subparagraph 2.2.6.1.1)
Step 2 Pulse Level Tolerances, ATCRBS-Only All-Call (Subparagraph 2.2.6.1.2)
Step 7 Short Pulse Rejection, ATCRBS-Type Interrogations (Subparagraph 2.2.6.3 c)
Step 8 Sync Phase Reversal Position Tolerance (From P1) (Subparagraph 2.2.6.4)
Step 9 Sync Phase Reversal Position Tolerance (From P6) (Subparagraph 2.2.6.4)

Multiple test steps run at multiple levels or 5 dB steps.

2.4.2.6 Transponder Recovery and Desensitization (Subparagraph 2.2.7)

Step 1 ATCRBS Single Pulse Desensitization and Recovery (Subparagraphs 2.2.7.1.1 and 2.2.7.2)
Step 5 Narrow Pulse Performance (Subparagraph 2.2.7.l.2)

These tests verify desensitization by setting signal spacing to a specific value and then test recovery at another specific spacing. These tests could be expanded to vary the spacing in 1-microsecond increments to acquire a more detailed measurement of desensitization and recovery characteristics.

2.4.2.7 Response to Interference (Paragraph 2.2.8)

Multiple test steps run at multiple levels or 5 dB steps.

2.4.2.11 Diversity Operation (Subparagraphs 2.2.12 and 2.2.20 d)

Step 1 Single Channel Test (Subparagraphs 2.2.12.3 and 2.2.12.4)
Currently this test runs at 3 power levels. A more complete test would step the power levels in 1 dB steps.

Step 2 Selection Test (Subparagraph 2.2.12.1. b)
Currently the test uses one relative power level between the two channels. If the relative power level was varied in 1-dB steps, a more exact channel selection based on signal level would be determined.

Step 3 Delay-Selection Test (Subparagraph 2.2.12.2)

Currently the test uses one delay position. If the test was expanded to vary the range in 25 nanosecond steps, there would be more of an exact measure of the Delay Selection Tolerance.